**Purpose**: To describe possible side effects and clinical implications of the use of common over the counter (OTC) and prescription medications in the older adult population, and to increase physical therapists’ knowledge about how to assess the risk of an adverse drug event in an older adult.

**Objectives**:

* To learn what an adverse drug event is and to list the most common drugs associated with adverse drug events
* To learn about how the use of the STOP/START criteria can assess the appropriateness of medications in the elderly population
* To learn about the most common side effects of OTC and prescription medications used in the older adult population.
* To learn how common medications could affect exercise response and exercise prescription in the older adult population.
* What to tell older adults to ask their doctor when they receive a new prescription medication
* Give an example of a case study of a common patient complaint who recently started taking a new medication

**Adverse drug events in the older adult population**:

* Adverse drug events (ADE) are an important public health issue in the older adult population, with ADEs being seven times more common in 70 to 79 year olds as compared to in 20 to 29 year olds.1
* Most ADEs (80%) are due to inappropriate dose.2
* 60% of ADEs that lead to hospital admission are due to seven drugs, which include antibiotics, anticoagulants, digoxin, diuretics, hypo-glycemic agents, anti-neoplastic agents and nonsteroidal anti-inflammatory drugs (NSAIDs).2
* Frail older adults are more at risk for ADEs.2
* Adverse drug events are any injuries caused by taking a medication, which can include allergic reactions, overdoses, and even death.
  + An ADE is different from a side effect of a drug, since certain side effects of some drugs can be beneficial to the patient.

**The STOPP/START criteria**:

* Previously, the Beers criteria were the most commonly used criteria for assessing the appropriateness of medication use in the elderly, but they have some limitations.3
* The STOPP/START criteria were developed to address these limitations.3
  + Both the Beers criteria and the STOPP/START criteria can be used to predict adverse drug effects, emergency department visits, and hospitalization, but the STOPP/START criteria slightly outperform the Beers criteria. 3
* STOPP (screening tool of older person’s prescriptions) includes 65 clinically significant criteria that indicate potentially inappropriate prescribing. Each criteria includes a brief explanation as to why the particular prescribing practice is inappropriate.4
  + See link below for all 65 criteria
* A potentially inappropriate medication is defined as a medication where the risk of adverse effects outweighs the benefit.5
* START (screening tools to alert doctors to the right treatment) includes 22 evidence-based indications for prescribing certain medications for common diseases in older adults.5
  + See link below for the 22 indicators
* Both tools have good inter-rater reliability, with a kappa coefficient of 0.75 for the STOP and 0.68 for the START.3

**Common over the counter (OTC) medications and dietary supplements and their side effects on the older adult population**:

* The average number of OTC medications taken by adults over 65 is 1.8.6 This varies with gender, race, and geographical area.6
  + Higher use of OTC medications in women, in Caucasians, and in the Midwest.6
* The most commonly used OTC medications are NSAIDs, laxatives and nutritional supplements.
* Common NSAIDs: Aspirin, Naproxen, Ibuprofen
  + Side effects: nausea, vomiting, gastric bleeding, ulcers, diarrhea, acute kidney failure, photosensitivity, increased blood pressure
  + Special precautions in older adults: if the patient is over 75 and has a history of ulcers, a medication to protect the stomach against bleeding may be needed, such as a proton pump inhibitor like omeprazole (Prilosec)
* Common laxatives: Metamucil, Citrucel, FiberCon
  + Side effects: dehydration, hypotension tachycardia, dizziness, syncope, acid-base imbalance, and electrolyte imbalances
  + Special precautions in older adults: older adult’s kidneys have a harder time maintaining homeostasis in the body, so there is an increased risk of acid-base imbalance and electrolyte imbalance in older adults who take laxatives
* In one survey of 3,005 older adults, 1 in 8 used more than 5 dietary supplements
  + The prevalence of dietary supplement use is more common in women
* The most common dietary supplements are glucosamine, chondroitin, and omega-3 fish oils. The use of Gingko bilboa and garlic has declined in recent years, which is attributed to an increase in the knowledge of their side effects.
  + Side effects of omega-3 fish oil:
    - when used with warfarin, the risk of bleeding significantly increases
    - a beneficial effect is that studies have found that fish oil supplements can increase post-exercise mitochondrial and myofibrillar protein synthesis in older adults
    - studies have also found that fish oil supplements can reduce mitochondrial oxidant emissions and enhance the anabolic response to exercise

**Common prescription medications used in older adults and their side effects6,7:**

* Muscle relaxants: such as cyclobenzaprine (Flexeril), methocarbomol (Robaxin), carisoprodol (Soma)
  + Side effects: confusion, grogginess, constipation, dry mouth, urinary problems
  + Special precautions in older adults: increased fall risk as compared to the younger population
* Anti-anxiety and anti-insomnia drugs: such as diazepam (Valium), alprazolam (Xanax) or chlordiazepoxide (Librium) as well as non-benzodiazepine sleeping pills, such as zaleplon (Sonata) and zolpidem (Ambien).
  + Side effects: confusion, grogginess
  + Special precautions in older adults: increased risk of falls as compared to the younger population, not cleared from the body as quickly as in younger adults, so they have a longer period of time when they are active in the body and thus may cause grogginess and sleepiness for an extended period.
* Anticholinegic drugs: such anti-depressants like amitriptyline (Elavil) and imipramine (Tofranil), the anti-Parkinson's drug trihexyphenidyl (Artane), the irritable bowel syndrome drug dicyclomine (Bentyl), the overactive bladder drug oxybutynin (Ditropan) and antihistamines such as Benadryl
  + Side effects: constipation, dry mouth, confusion, urinary issues, blurry vision, lowered blood pressure
  + Special precautions in older adults: increased risk of confusion as a side effect, increased risk of low blood pressure as a side effect, due to decreased baroreceptor response in the older adults
* Heart medications: such as Digoxin (Lanoxin), Amlopidine (Norvasc), Atenolol (Tenormin), Betaxolol (Kerlone), and Metoprolol (Lopressor)
  + Side effects: dizziness, headache, rash, hypotension, weakness, fatigue, headache, and constipation
  + Special precautions in older adults: since older adult’s kidneys do not clear medications from the body as effectively, there is increased risk of digitalis toxicity in older adults, manifested by palpitations, drowsiness, dizziness, shortness of breath, dyspnea, hypotension, and visual changes such as decreased visual acuity and yellow-green distortion. These drugs also increase the risk of dizziness in older adults that may result in a fall.

**Exercise and medications8**:

* Beta blockers:
  + Blunt the usual increase in heart rate and blood pressure that occurs with higher intensities of exercise
  + HR and BP are not appropriate ways to measure exercise intensity in a patient who is on beta blockers, need to use RPE instead
    - See link below for a printable version of RPE chart to use in the clinic
  + Beta blockers can also mask the symptoms of hypoglycemia in patients who have diabetes, so blood glucose should be checked both halfway through the exercise session and once the exercise session is finished to ensure blood glucose is in a safe range
* ACE inhibitors:
  + Due to these medications effect of lowering BP, the normal post-exercise hypotension that occurs after activity can decrease their BP to dangerously low levels, which can cause dizziness and syncope
  + Need to measure the patient’s BP at the conclusion of exercise and 5 and 10 minutes afterwards
  + Also need to have a cool-down period of at least 10 minutes to ensure the BP returns to normal levels gradually, the cool-down enhances venous return and prevents blood pooling in the extremities
* Diuretics:
  + Cause lower resting BP and lower resting HR
  + Similarly to ACE inhibitors, the combination of naturally occurring post-exercise hypotension and the BP reduction from the diuretic can cause a too low drop in BP
  + Need to have at least a 10 minute cool down period and measure BP following exercise
  + Instruct the patient that they should weigh themselves daily to ensure the diuretic is still being effective; sudden weight gain could indicate that the dose needs to be adjusted and the patient should contact their physician
* Statins:
  + The incidence of exercise induced rhabdomyolysis is increased in those taking statins
    - Rhabdomyolysis: a condition where skeletal muscle damaged by intense exercise is broken down and releases substances that can be toxic to the kidneys
  + Rhabdomyolysis is more likely to occur with high intensity resistance training, especially eccentric exercises
  + For those taking statins, the PT needs to begin resistance training and aerobic exercise at a low intensity and gradually increase the intensity
  + Education should be provided to the patient regarding the most common signs and symptoms of rhabdomyolysis, including dark, soda-colored urine and onset of significant muscle stiffness or pain following exercise
  + Adequate hydration before and after exercise can also help decrease the risk of developing rhabdomyolysis
* Oral hypoglycemics:
  + There are three classes of oral hypoglycemics used to control blood glucose in those with diabetes:
    - Beta-cell stimulants for insulin release
    - Drugs to improve insulin sensitivity
    - Drugs that decrease intestinal absorption of carbohydrates
  + For any patient taking any of the above classes of oral hypoglycemic medications, blood glucose needs to be monitored before exercise, at the halfway point of the exercise session, and at the end of the exercise session
    - Blood glucose levels below 70 mg/dL and above 300 mg/dL are a contraindication to exercise
    - If blood glucose levels are below 70 md/dL, have the patient eat a 30 gram carbohydrate snack and wait 30 minutes before beginning exercise
    - Signs of hypoglycemia are shakiness, pale skin, dizziness, hunger, sweating, headache and seizure
    - Signs of hyperglycemia are fruity smelling breath, shortness of breath, nausea, and a very dry mouth
    - Hyperglycemia levels above 300 mg/dL are a medical emergency

**Important questions that older adults should ask their doctor when receiving a new medication**:

* What is the medicine for and what is it supposed to do?
* When should the medicine be taken and for how long?
* Should the medicine be taken with food or water?
* Can the medicine be taken with other prescription or over the counter medications?
* Should certain foods, medications, or exercises be avoided when taking the medication?
* What are the possible side effects?
* What should be done if a dose is missed?
* How will I know if the medication is working?
* Will this medication interact with dietary supplements or any other medications that I currently take?
* How should the medicine be stored?
* Ask the doctor for written instructions in case this information is forgotten.
* More information to give to older adults about the medicines they are taking can be found in the FDA document link below.

**Case study9**:

* A 72 year old female that a PT is treating for a history of recent falls complains of recently feeling weak and reports a new rash four weeks after starting taking an NSAID for knee pain after her most recent fall
* What the PT should do:
  + Ask about whether she had any feelings of weakness prior to taking the drug, does she have a history of GI, heart, or lung disease?, when did the rash start? Has she noticed any other systemic symptoms?
  + Be sure to ask about any history of peptic ulcers, asthma, dyspepsia, and hear or kidney failure as these conditions can be worsened by NSAIDs and may result in her symptoms.
  + Advise her to call her physician and schedule an appointment to have her symptoms assessed and possibly request an alternative analgesic

**Other Resources:**

Tools to check possible drug interactions:

* <http://reference.medscape.com/drug-interactionchecker>
* <https://www.cvs.com/drug/interaction-checker>
* <http://www.umm.edu/health/medical/drug-interaction-tool>

Medicines and You: A Guide for Older Adults:

* <https://www.fda.gov/drugs/resourcesforyou/ucm163959.htm>

Links to all STOPP and START criteria:

* STOPP criteria: <http://mm.wirral.nhs.uk/document_uploads/other-topics/STOPP_START_Tool2015.pdf>
* START criteria: <https://www.ngna.org/_resources/documentation/chapter/carolina_mountain/STARTandSTOPP.pdf>

Link to downloadable RPE chart:

* <https://my.clevelandclinic.org/health/articles/rpe-scale-heart-health>

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